ToF Resolution

Jónatan Piedra, Iván Vila, Marcin Wolter

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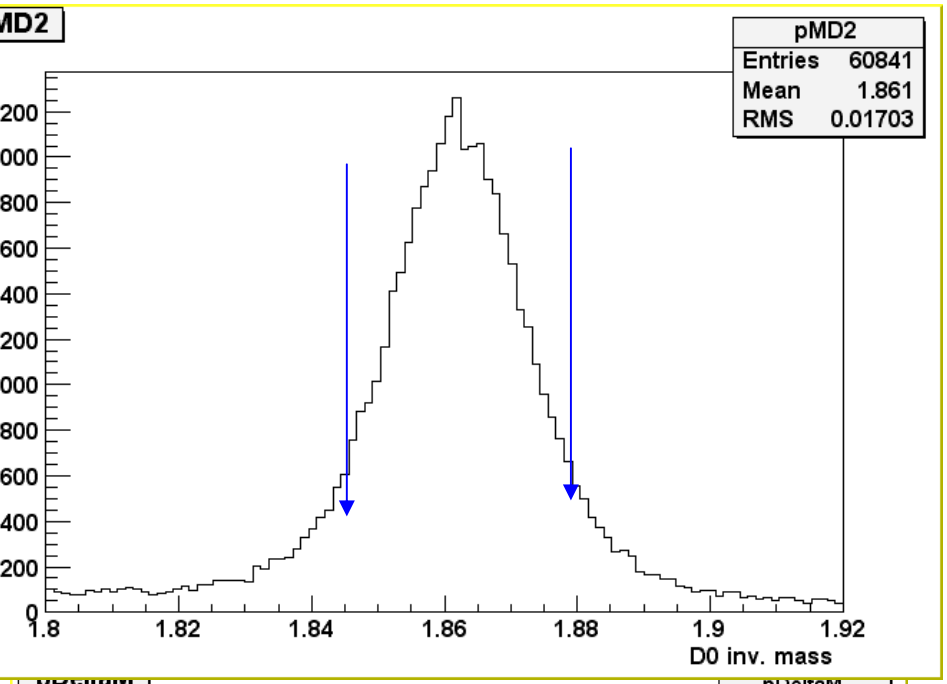
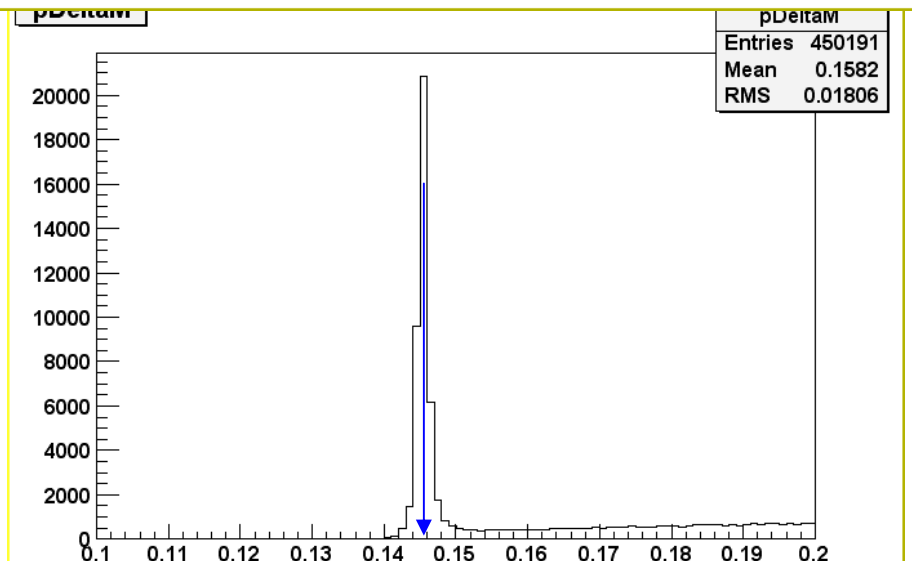
Outline

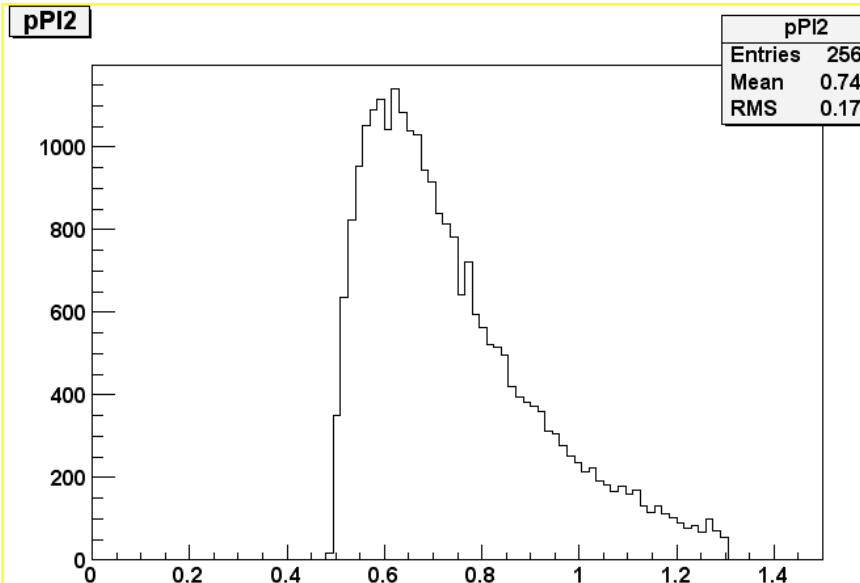
- Selection of pure Pion sample from D^* decays.
- Official ToF reconstruction:
  - TZero set NegLog
  - Pulses set Simple
  - Pulses_useTOFDCuts set true
  - Pulses_minAdcCut set 0
  - Pulses_minTdcCut set 0
  - Extrapolator set Geometric
  - Associator set TLR
- T_0 effect on resolution – in data and MC (Monte Carlo – see our note #6109 „*Opposite Side Kaon Tagging. A Monte Carlo Study for Run II*", J.Piedra, A. Ruiz, I. Vila, M. Wolter and Ch. Paus).
- Are the resolution tails due to T_0?

Soft Pions from D^*->Pi(D^0 -> K Pi)



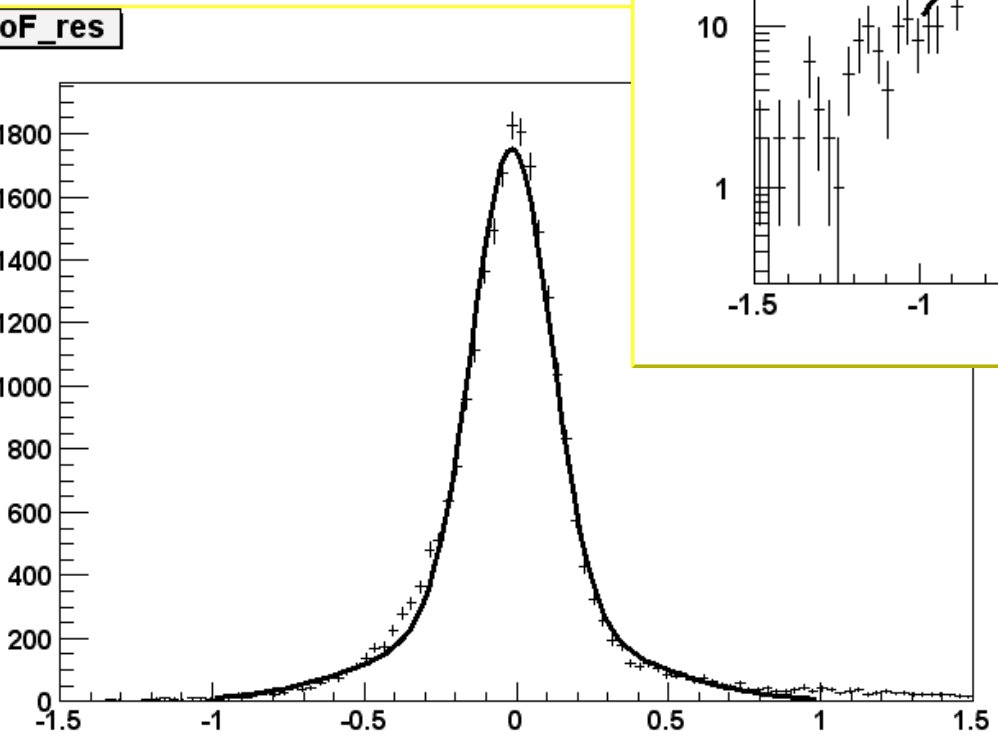
- One D^0 candidate
- D^0 mass peak (cuts: 1.845<M<1.875
- Mass difference between D^0 and D^* less than 0.145
- Pure Pion sample (~97%-98%)

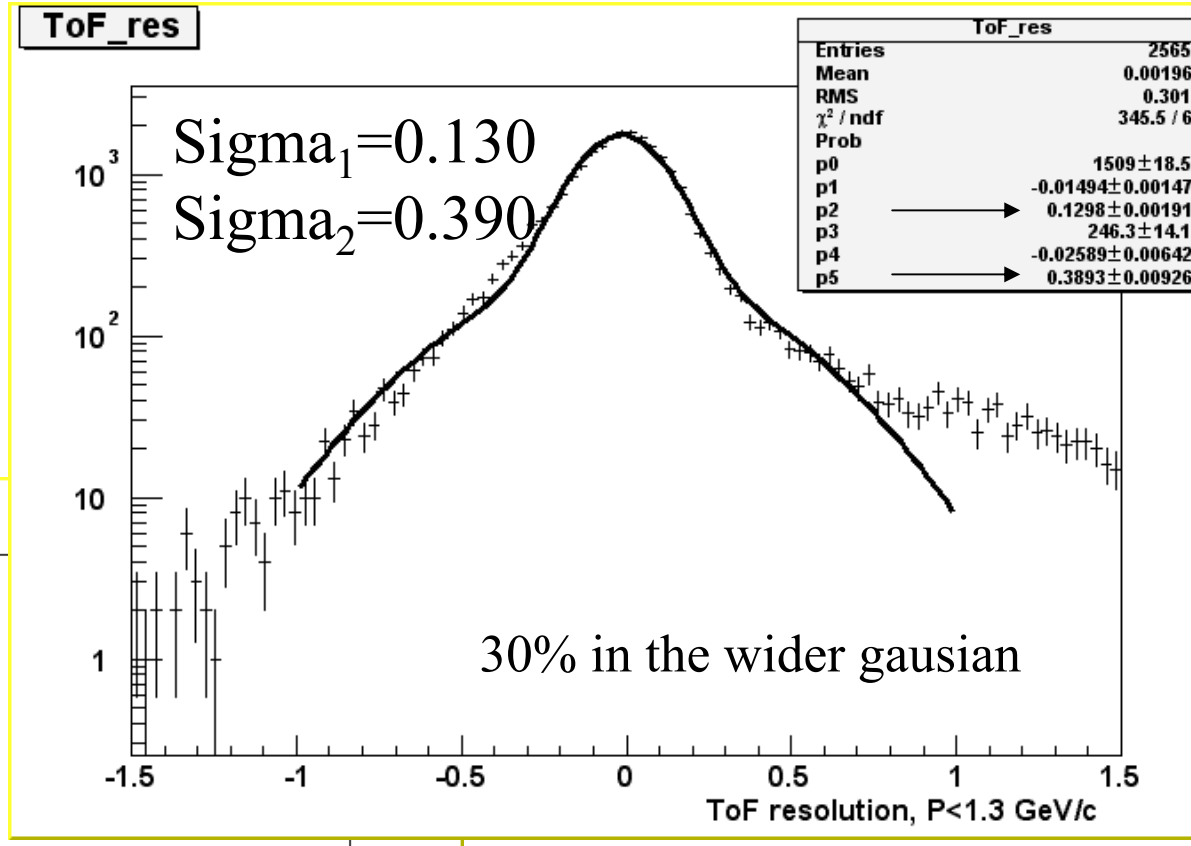




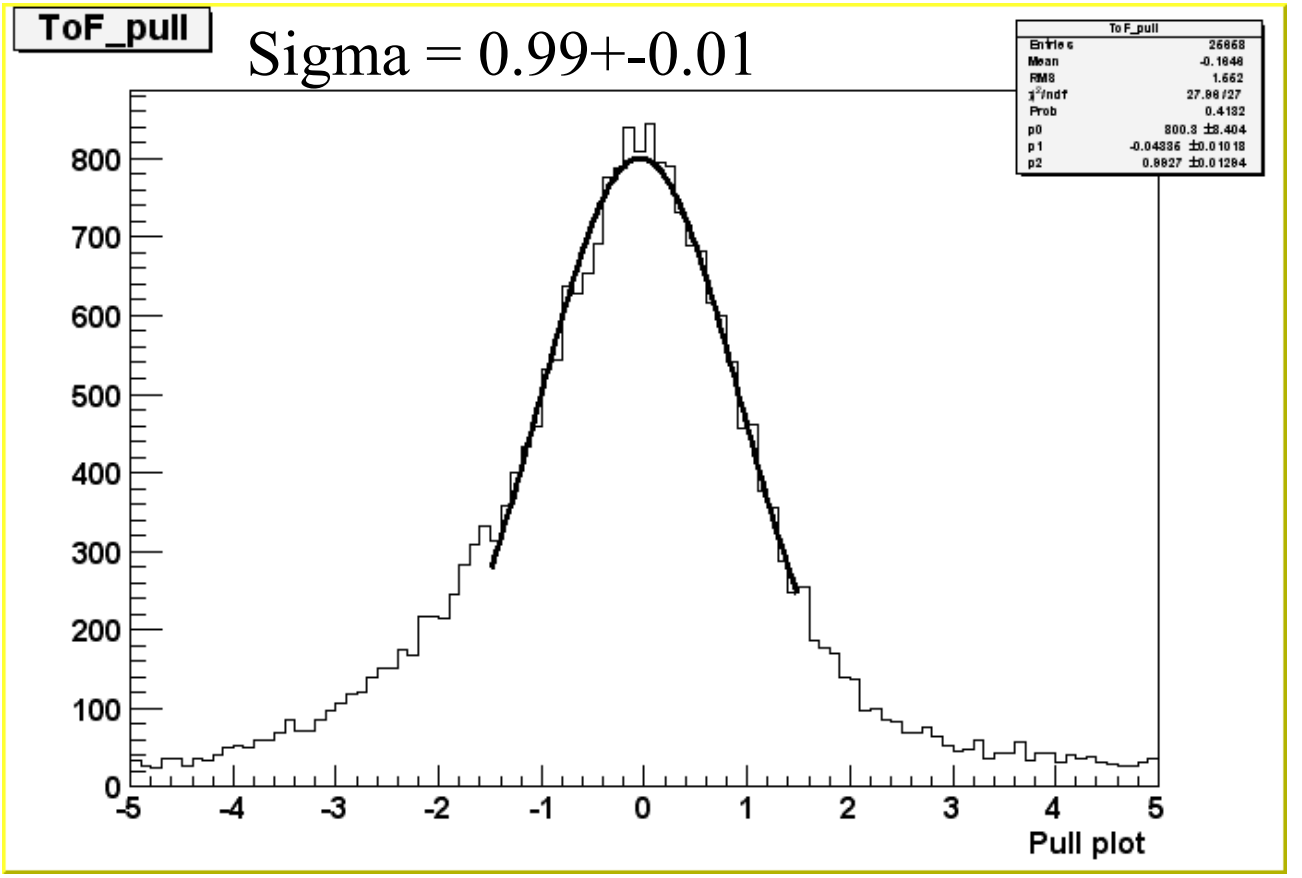
ToF resolution

ToF_{meas}-ToF_{Pion}

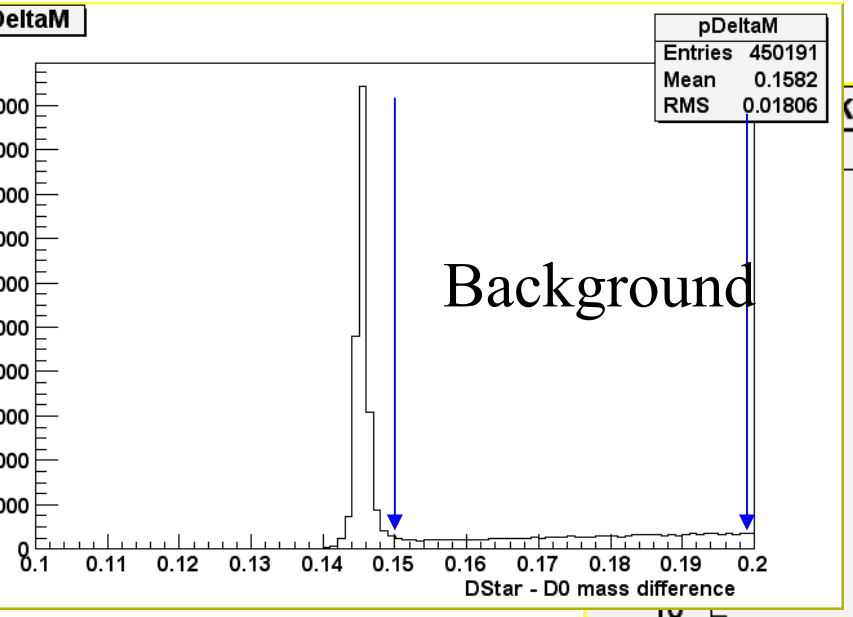


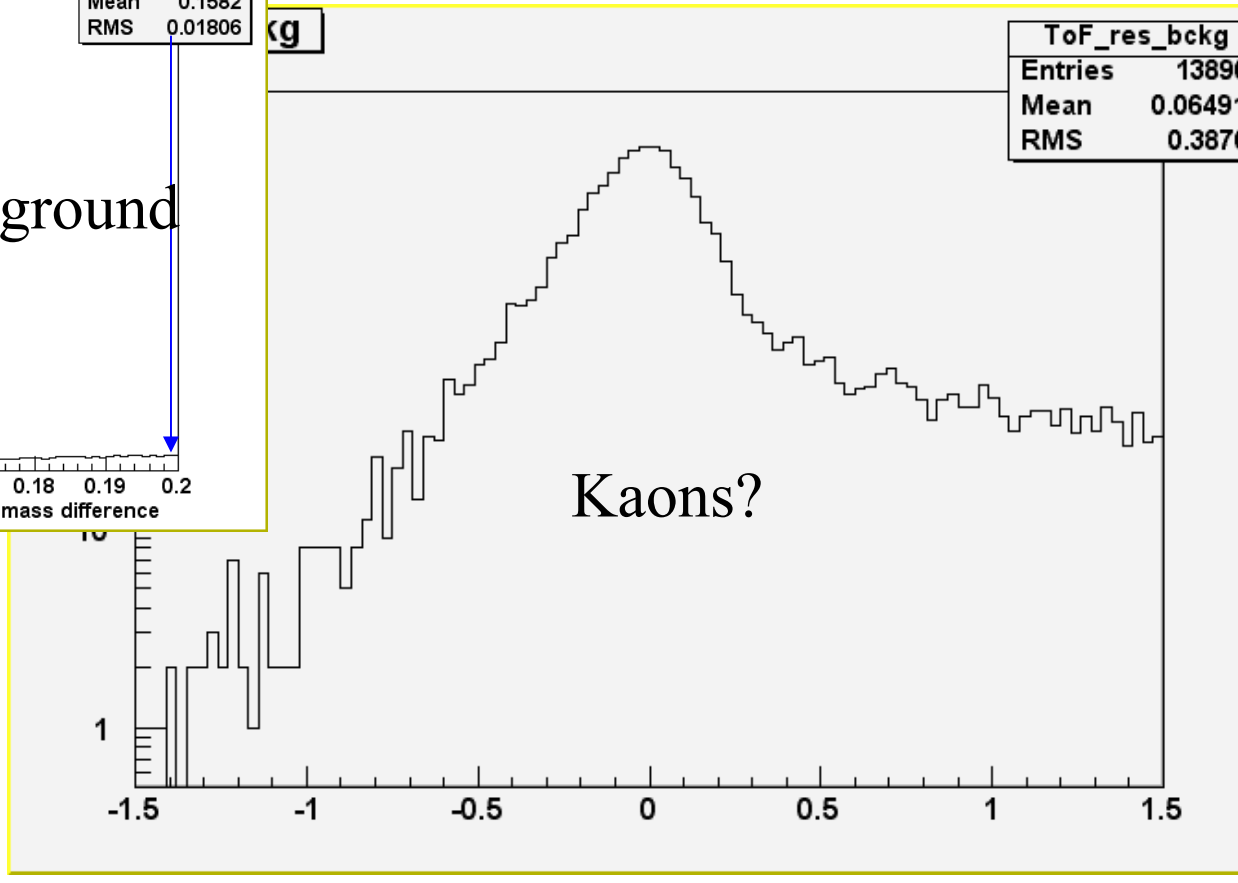


ToF pull distribution



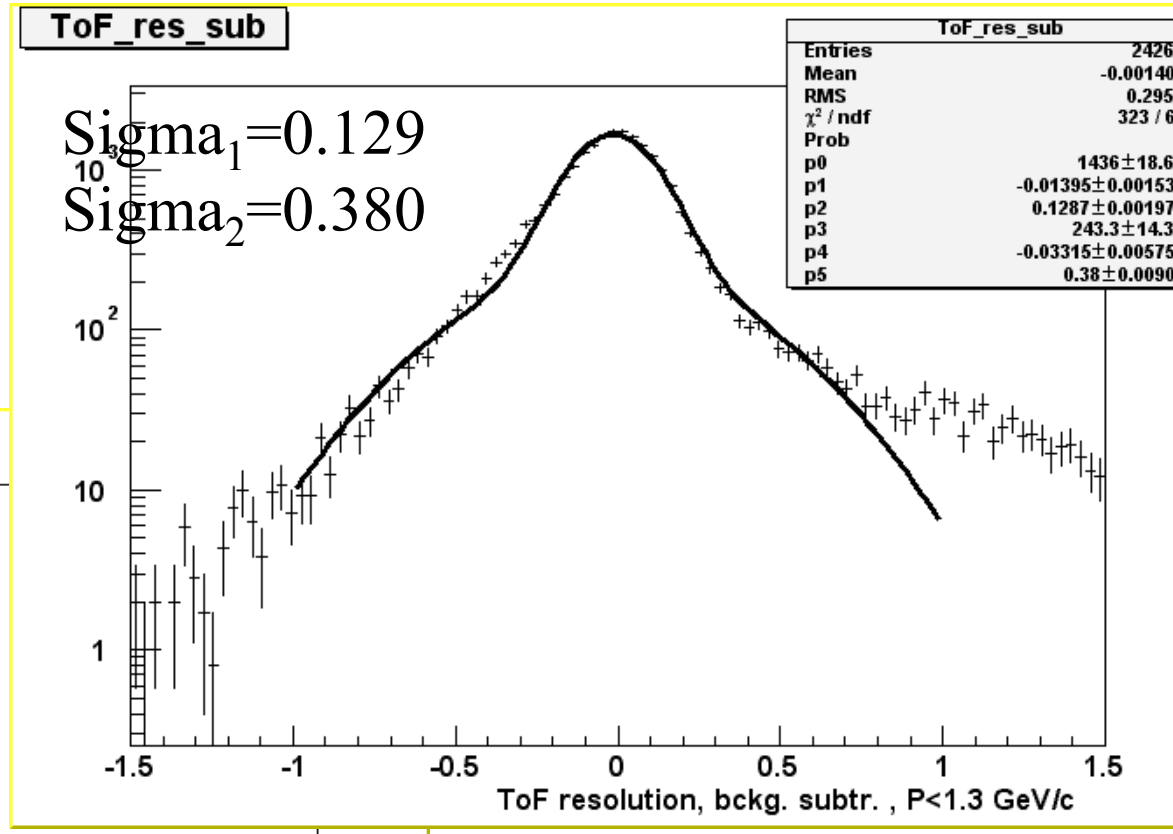
Background ToF resolution

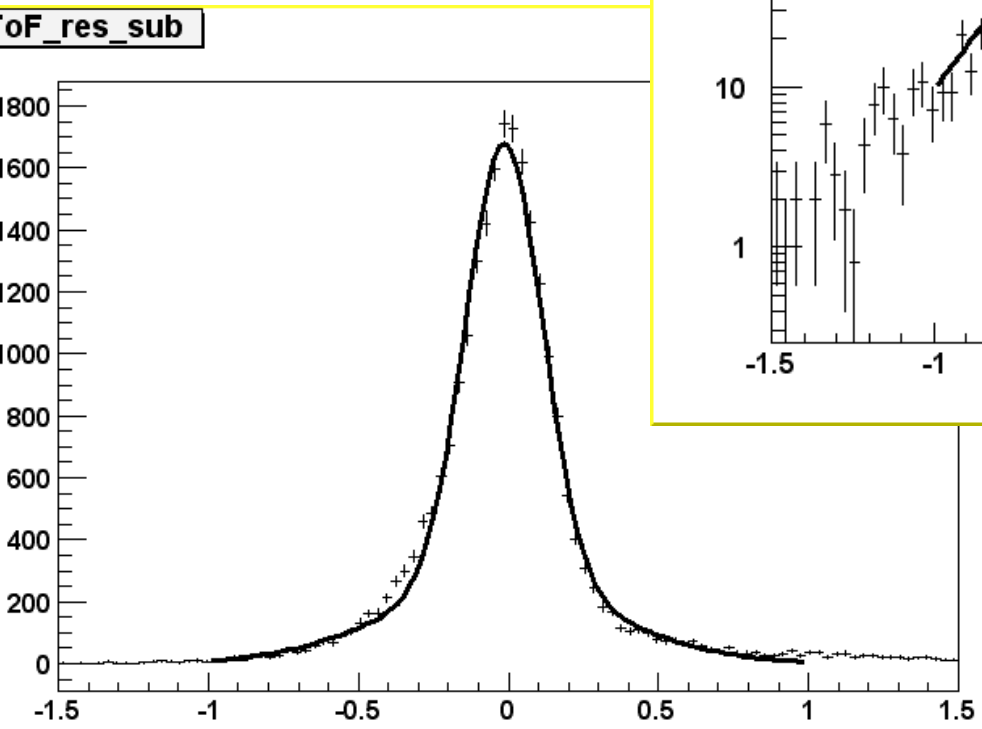




ToF resolution – background subtracted

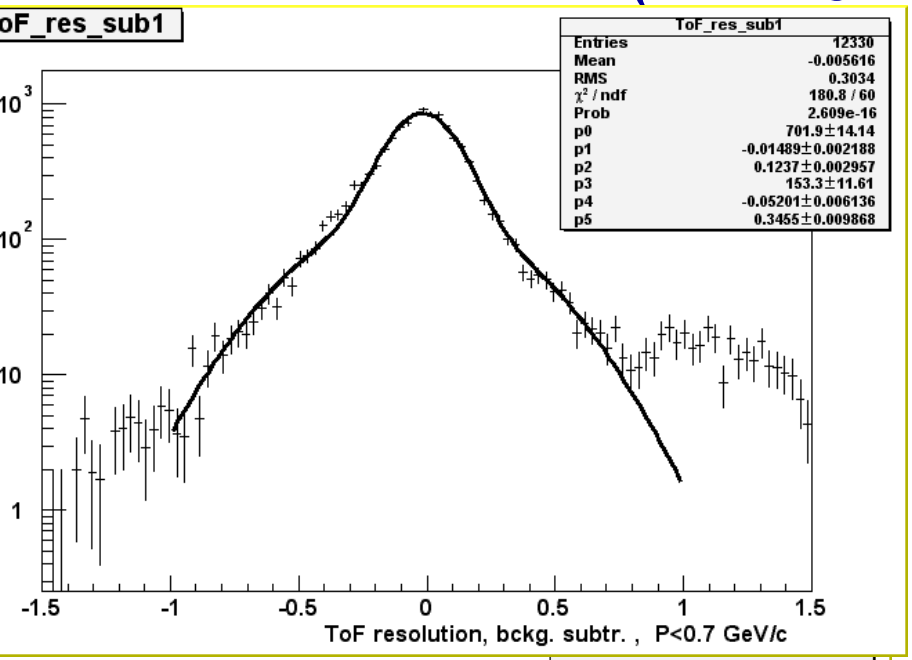
ToF_{meas}-ToF_{Pion}

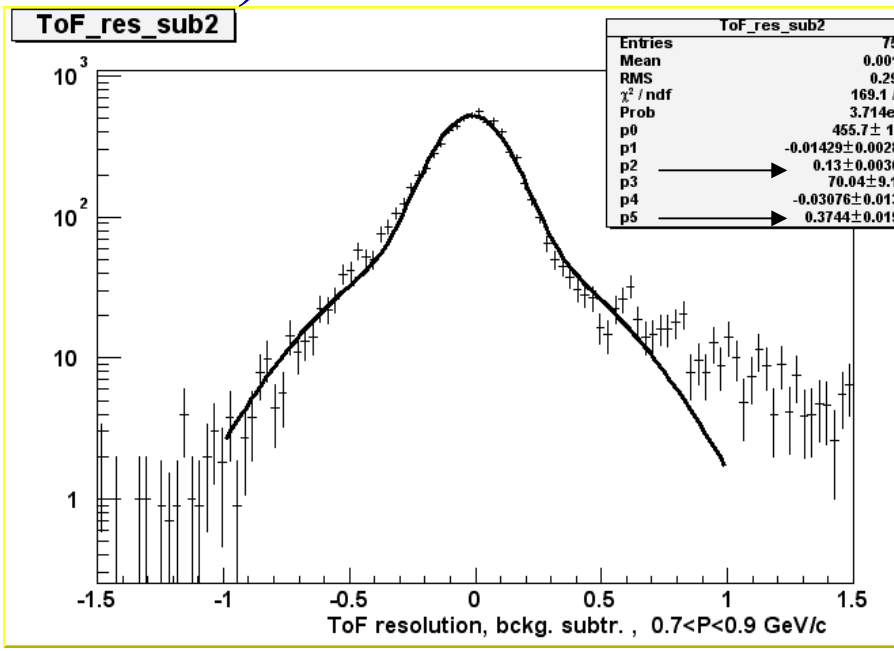


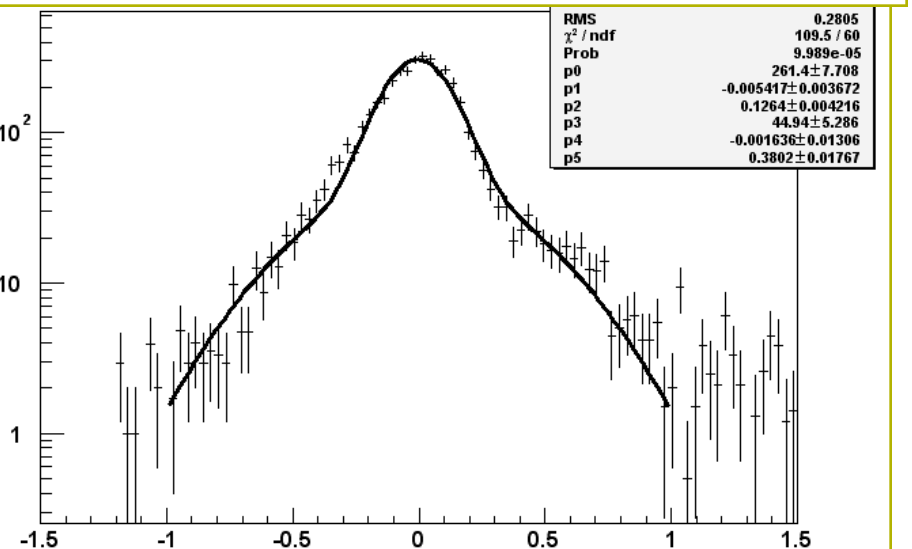


30% in the wider gausian

ToF resolution – background subtracted (in Pion Pt bins)







about 30% in the wider gausian

Monte Carlo simulation

- Full GEANT MC, about 14 000 events (same files as used by Jonatan)

  generated April 2002 – *„simple”* ToF model.
- MC generated with two different types of tracks: MITMC and PROD tracks – need different treatment.

Technicalities

- **CDF release 4.8.4**
- **Data object:**

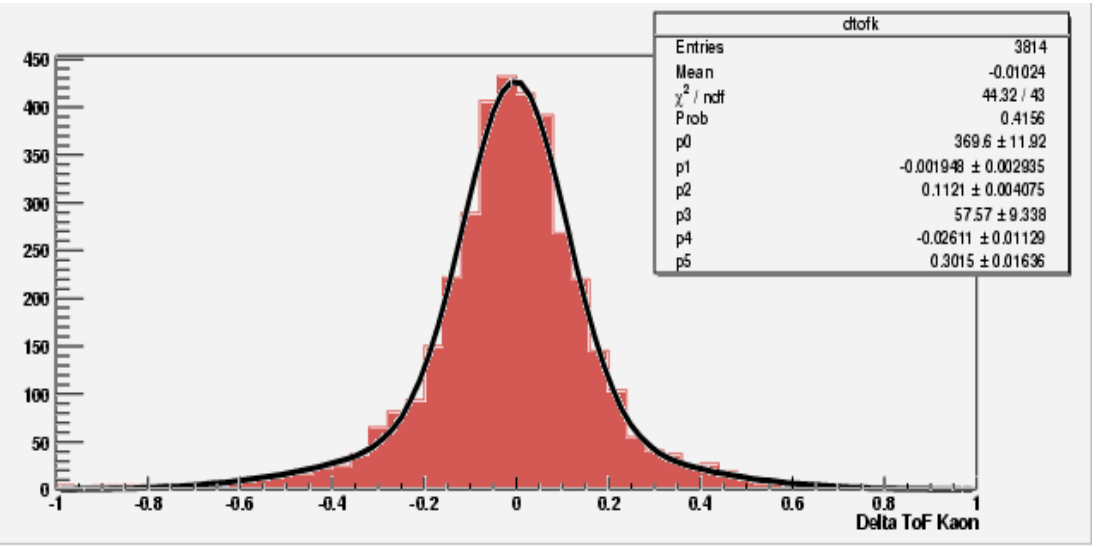
  TOFD, TofPulsesColl, TofMatchColl, TofMatch.
- **Reconstruction run again:**

  TOFD->TofPulsesColl -> TofMatchesColl

- **Reconstruction TofModule (tcl):**

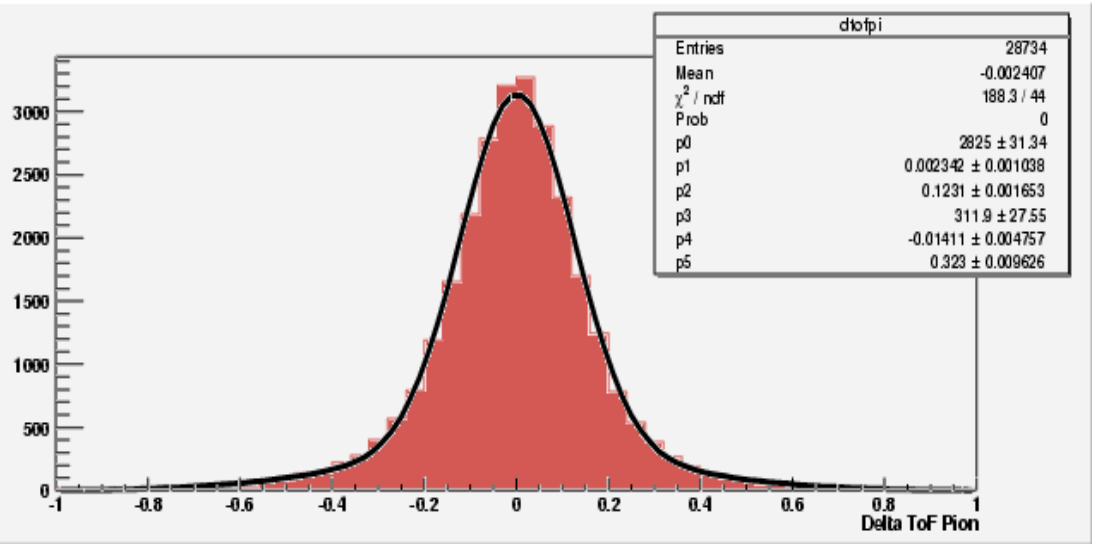
```
module enable  TofModule
module talk TofModule
  ReconMenu
    Pulses  set Simple
    Pulses_useTOFDCuts set true
    Pulses_minAdcCut set 0
    Pulses_minTdcCut set 0
    Extrapolator set Geometric
    Geometric_overrideProcName set true
    Geometric_procName        set MITMC
    Associator set TLR
    TZero      set NegLog
    exit
  CalibratorType set Dummy
exit
```

Simulated ToF



Kaons

σ_1=112 ps
σ_2=301 ps

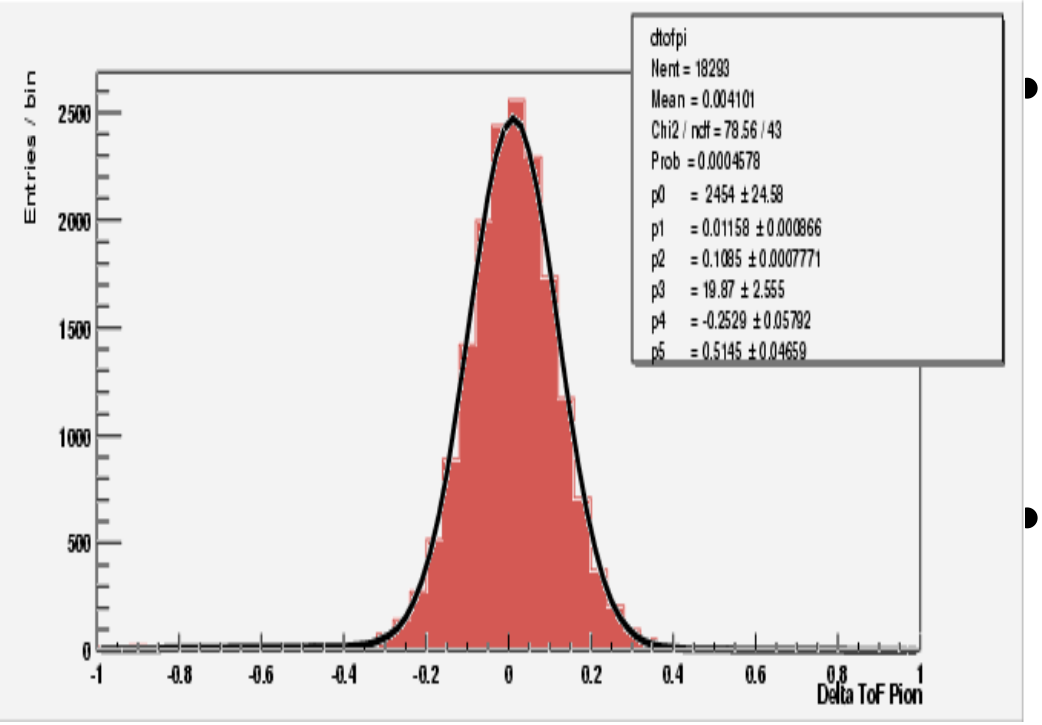


Pions

σ_1=123 ps
σ_2=323 ps (~25% of track

Simulated ToF - true ToF
Gaussian + tails
Fit – two gausians

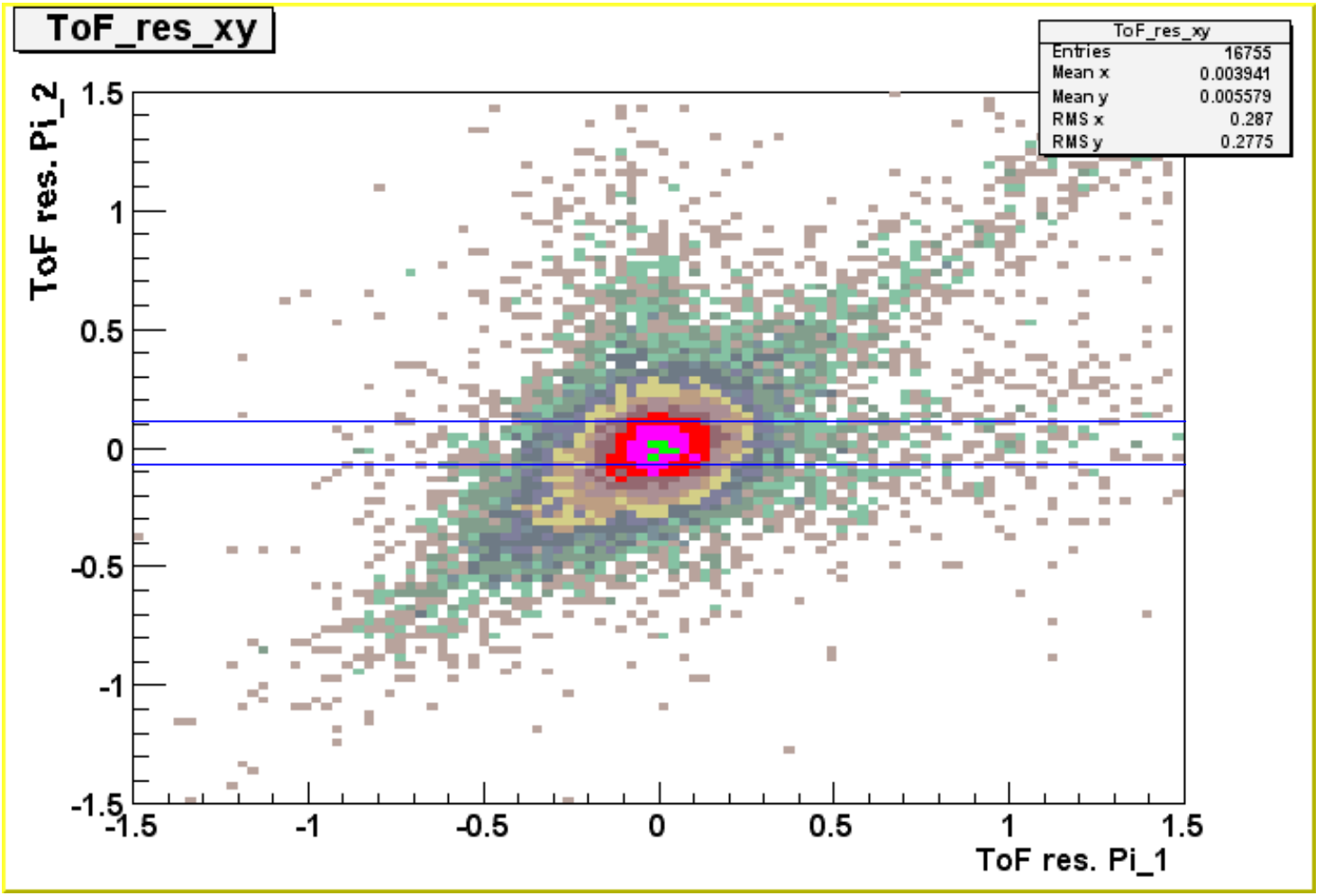
Replacing calculated T_0 by the true one



Pions, σ=108 ps

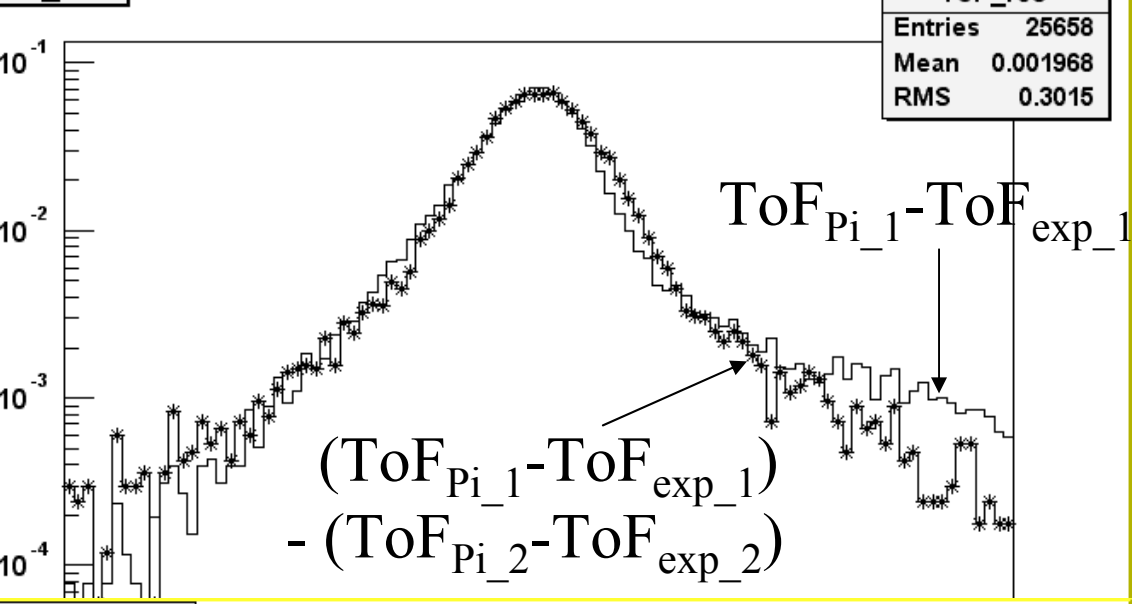
- Tails in the ToF resolution are due to the poor estimation of T_0.
- Cuting on T_0 error doesn't improve the resolution.

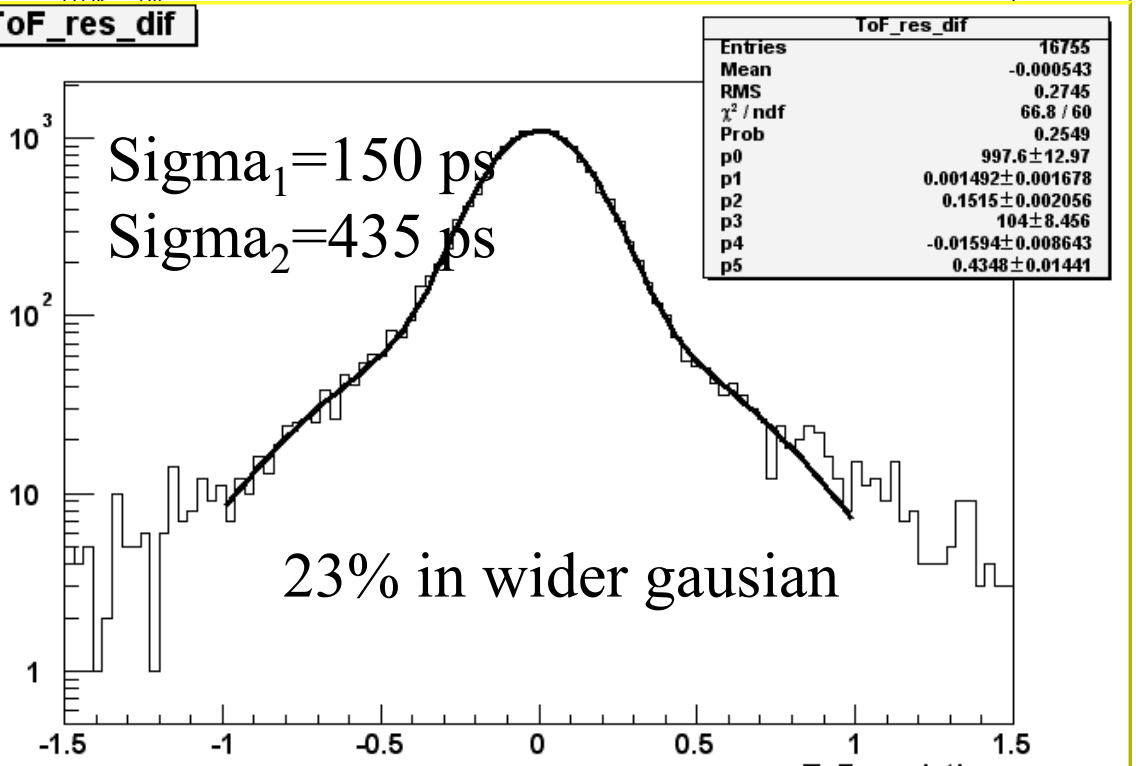
T_0 effect



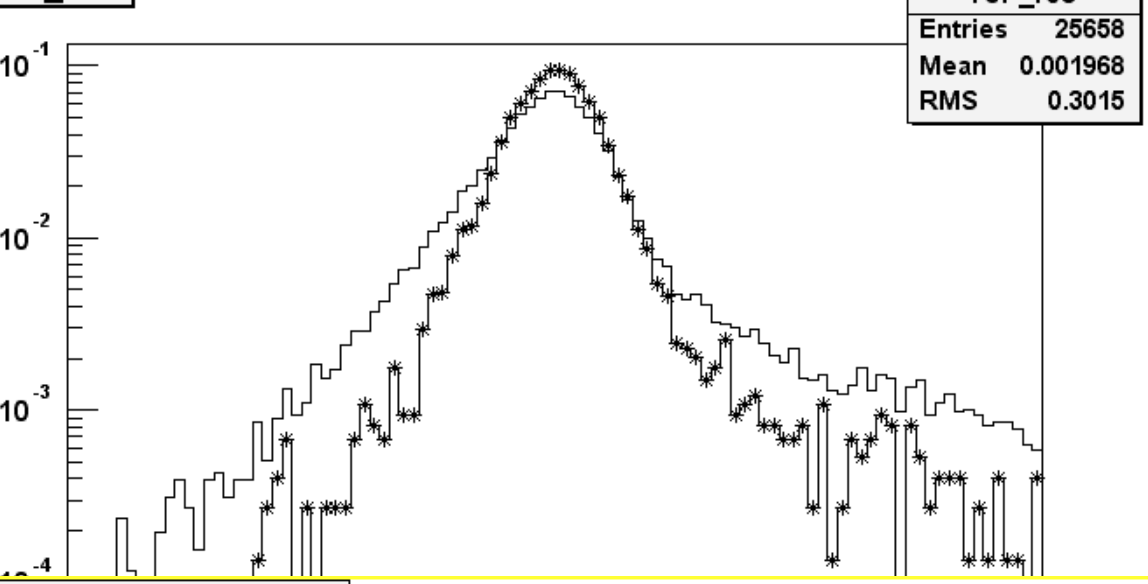
(ToF_{meas}-ToF_{Pi}) for Pions from D^* and D^0

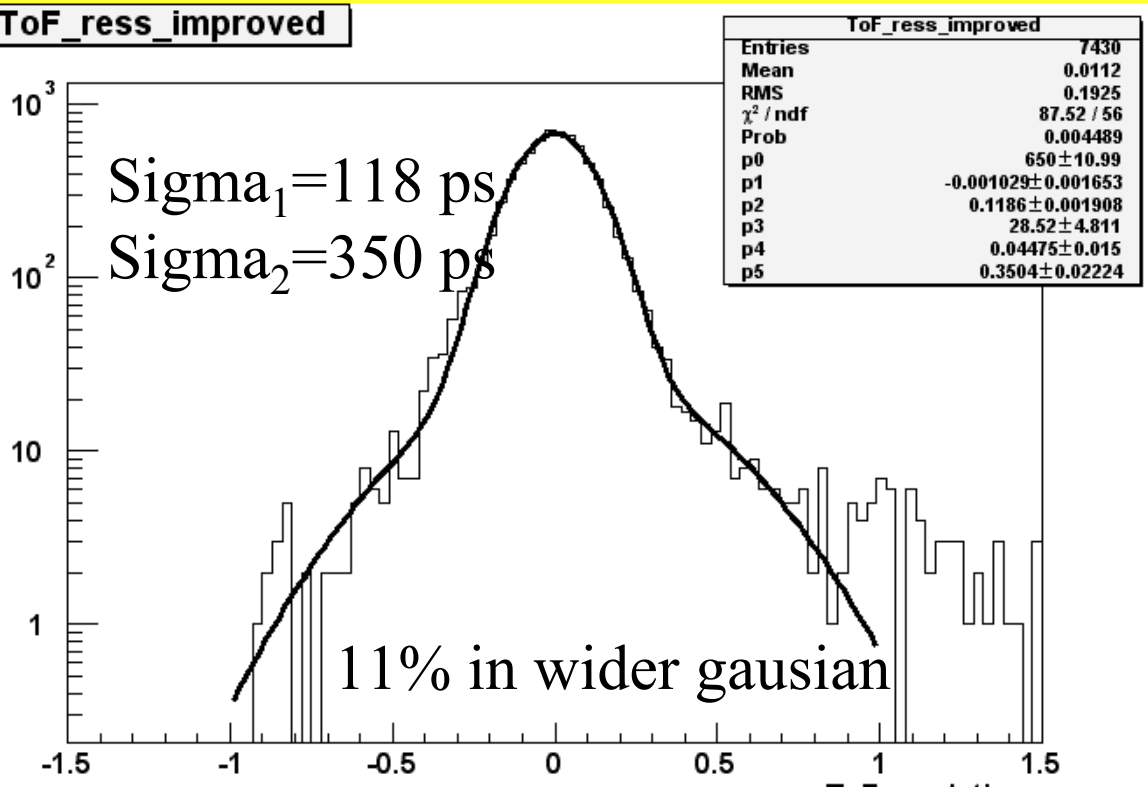
Correlation – T_0 effect (also non-correlated tails – non Pion admixture?)





Pion from D^0 decay used to calculate T_0.
Less events in the tails, however the central gausian is broader 150ps instead of 130 ps.
Also central gausian more symmetric.
Since matching required for both tracks efficiency is lower, i.e. 41% instead of 63%.





Pion from D^0 decay used to verify T_0 (only events with $|ToF-ToF_{Pi}|<0.1$ accepted).
Much less events in the tails, central gausian is narrower 118 ps instead of 130 ps, also more symmetric.

Significantly lower efficiency, 18% instead of 63%.

ToF resolution – few remarks

- Expected ToF resolution for T_0 calculation using another Pion: 118ps*sqr(2)=166 ps. We obtained 150 ps – reasonable agreement.
- After correcting for t0 there is still a 11% of cases with lower resolution, then for the time differences we expect this number to be twice as big, it is 22% assuming that the low resolution cases are independent (very good agreement with the 23%)

Conclusions

- We have a source of pure Pions to study ToF.
- Tails in the resolution due to errors in T_0.
- Having tagged track (Pi, K) we can improve ToF resolution, but efficiency can decrease.

		MC-Pions	Data-Pions
ormal	$Sigma_1$	123 ps	129 ps
	$Sigma_2$	323 ps	380 ps
	Wide gausian	25%	30%
o T_0 effect	Sigma	108 ps	118 ps
	Wide gausian	--------	11%

sigma(T_0) distribution